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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/781,684	02/20/2004	Hai-Zhi Song	040070	3691
23850	7590	07/01/2005	EXAMINER	
ARMSTRONG, KRATZ, QUINTOS, HANSON & BROOKS, LLP 1725 K STREET, NW SUITE 1000 WASHINGTON, DC 20006			DICKEY, THOMAS L	
			ART UNIT	PAPER NUMBER
			2826	

DATE MAILED: 07/01/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/781,684

Applicant(s)

SONG, HAI-ZHI

Examiner

Thomas L. Dickey

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 12 May 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-16 is/are pending in the application.
- 4a) Of the above claim(s) 12-16 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-7, 9 and 11 is/are rejected.
- 7) ☒ Claim(s) 8 and 10 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

*Minhloan Tran*  
**Minhloan Tran**  
**Primary Examiner**  
**Art Unit 2826**

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 20 February 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

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## DETAILED ACTION

1. The amendment filed 05/12/2005 has been entered.

### ***Claim Rejections - 35 USC § 102***

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-7, 9, and 11 are rejected under 35 U.S.C. 102(b) as being anticipated by KIEHL (5,559,343).

With regard to claims 1-7, and 9 Kiehl discloses a quantum semiconductor device with a first semiconductor layer 14a formed over a substrate 11; a two-dimensional carrier gas (2DEG) formed in (note that doped AlGaAs barrier layer 13a causes the 2DEG gas to form in GaAs first semiconductor layer 14a by way of a well known quantum phenomenon. It has been well known in the art for many years, 2DEG gases form in GaAs layers at the interface between GaAs layers and doped, higher band gap AlGaAs layers. In point of fact those skilled in the art, i.e., physicists, understand that a 2DEG layer will form at the interface between any relatively low bandgap material, in this particular case GaAs, and an adjacent, doped, high band gap material, in this case Al-

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GaAs. See, for example, column 4 lines 40-54 of Seabaugh 5,408,106, or column 1 lines 37-48 of Petroff 5,192,709. A succinct, but somewhat more recent, review of the basic physics that compels those skilled in the art to realize that 2DEG and 2DHG layers form at GaAs/AlGaAs interfaces such as Kiehl's 14a/13a interface is found at column 1 lines 10-31 Patel et al. 5,701,017) first semiconductor layer 14a; a first, three-dimensionally grown (note column 5 line 64 spanning through to column 6 line 4) island quantum dot 21a formed over the first semiconductor layer 14a; a second semiconductor layer 14b formed over the first semiconductor layer 14a, burying the first quantum dot 21a; a gate electrode 25b connected to a dot-shaped structure 21b (wherein the dot-shaped structure 21b is simply, in accordance with claim 9, a second quantum dot) caused to formed by crystal strains on the surface of the second semiconductor layer 14b at a position above the first quantum dot 21a, source 26/drain 25a regions connected to both ends of a channel region 12 defined by a depletion region DP formed in a region of the first semiconductor layer 14a which is below the oxide layer 23, and an oxide layers 23 formed on both sides of the dot-shaped structure 21b on the upper surface of the second semiconductor layer 14b. Note figures 5, 8A-8G, 11 and column 6 lines 1-4 and 35-54, column 8 lines 24-67, column 9 lines 5-30, and column 10 lines 10-14 of Kiehl.

The applicant's claims 2-5 does not distinguish over the Kiehl reference regardless of the process used to form the claimed crystal strains, three-dimensionally grown island quantum dot 21a and dot-shaped structure 21a, and depletion region DP, because

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only the final product is relevant, not the recited processes of generating the crystal strains in the surface of the second semiconductor layer due to the presence of the quantum dot 21a, self-assembling the quantum dot and the dot-shaped structure by S-K mode, and forming the depletion region due to the presence of the oxide layer.

Note that a “product by process” claim is directed to the product per se, no matter how actually made. In re Hirao, 190 USPQ 15 at 17 (footnote 3). See also In re Brown, 173 USPQ 685; In re Luck, 177 USPQ 523; In re Fessmann, 180 USPQ 324; In re Avery, 186 USPQ 161; In re Wertheim, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); and In re Marosi et al., 218 USPQ 289, all of which make it clear that it is the patentability of the final product per se which must be determined in a “product by process” claim and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in “product by process” claims or not. Note that applicant has the burden of proof in such cases, as the above caselaw makes clear. See also MPEP 706.03(e).

With regard to claim 11, which is a necessary method of making the quantum semiconductor device of claim 1, Kiehl discloses a method of making said quantum semiconductor device comprising the steps of forming over a substrate 11 a first semiconductor layer 14a with a two-dimensional carrier gas formed in; forming a first quantum dot 21a over the first semiconductor layer 14a; forming a second semiconductor layer 14b, burying the first quantum dot 21a; forming a dot-shaped structure 21b on the surface of the second semiconductor at a position above the first quantum dot 21a due to

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strains generated in the surface of the second semiconductor layer 14b due to the presence of the first quantum dot 21a; and forming oxide layers 23 on the upper surface of the second semiconductor layer 14b on both side of the dot-shaped structure 21b with the dot-shaped structure 21b as a mark (note that dot-shaped structure 21b marks stressor 17 which in turn marks oxide layers 23). Note figures 5, 8A-8G, 11 and column 6 lines 1-4 and 35-54, column 8 lines 24-67, column 9 lines 5-30, and column 10 lines 10-14 of Kiehl.

### ***Allowable Subject Matter***

3. Claims 8 and 10 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

### ***Response to Arguments***

4. Applicant's arguments filed 05/12/2005 have been fully considered but they are not persuasive.

It is argued, at page 9 of the remarks, that "Since the barrier layer 13 between adjacent pair of precipitates 21 are sufficiently narrow, a charge on one precipitate 21 can tunnel through the barrier layer 13 to the adjacent precipitate 21. Such tunneling can be controlled by potential distribution in the superlattice structure 13, 14." However, there is nothing in applicant's claims that prohibits applicant's claimed invention from exhibiting

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the behavior applicant describes here. Applicant therefore appears to be arguing that the reference fails to show certain features of applicant's invention, of which it may be noted that the features upon which applicant relies (i.e., narrow barrier layer that allows tunneling from one quantum dot – Kiehl calls his nanoscale dots 21 of metal embedded in semiconductor “precipitates” for some reason, possibly related to how they are formed – to another) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

It is argued, at page 10 of the remarks, that “The GaAs layer 14a is only a matrix of the arsenic precipitates 21a.” However, Kiehl makes clear that GaAs layer 14a is a semiconductor layer. Note figure 10A, which shows the band structure in GaAs layer 14a along line XA in figure 8B. Line XA crosses layer 14a well away from quantum dot 21a. Figure 10A shows a band structure for layer 14a that is typical of any GaAs semiconducting layer. Note that the band gap in layer 14a is a little over 2 eV, which guarantees that the material will exhibit semi-conductive behavior.

It is further argued at page 10, that “A two-dimensional carrier gas is not formed in the GaAs layer 14a.” However, as Patel et al. 5,701,017 makes clear at column 1 lines 10-31, a 2DEG is always formed at the interface between a doped AlGaAs barrier layer such as Kiehl's layer 13a and a GaAs layer such as Kiehl's layer 14a.

It is argued, at page 11 of the remarks, that “The dielectric layer 23 of Kiehl is for insulating the gate electrodes 25b, 25c from the mesa structure. The dielectric layer 23 of

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Kiehl is not for forming a depletion region in the GaAs layer 14a.” Applicant appears to be referring specifically to claim 5, which is the only claim that claims forming a depletion region. However, as explained above, with a “product by process” claim such as claim 5, only the final product is relevant, not the recited process of forming a depletion region due to the presence of an oxide layer. Also as explained above, the cases assign applicant the burden of proof. Proof means evidence. Attorney arguments, such as put forth on page 11, are not evidence.

It is argued, at page 12 of the remarks, that “However, the precipitate 21b of Kiehl does not correspond to a dot-shaped structure as claimed in the present application. The function of the precipitate 21b is similar to the function of the precipitate 21a. The precipitate 21b does not function as a mark when the dielectric layer 23 is formed.” However, it is should be expected that dot-shaped structure (or precipitate, as Kiehl calls it) should function exactly as does quantum dot 21a. In order to meet claim 9, dot shaped structure 21b must be “another quantum dot” (in the words of claim 9), i.e. it must have exactly the same structure as quantum dot 21a. It is unsurprising that a second element “dot-shaped structure” 21b, having the exact structure as a first element, “quantum dot” 21a, should have a function “similar,” as applicant phrases it, to its twin structure. Further, dot-shaped structure 21b clearly “marks” dielectric layer 23. According to Kiehl, stressor 17 is aligned with dot-shaped structure 21b by virtue of the strain field in the semiconductor superlattice structure (note column 8 lines 18-22). Dielectric layer 23 is then aligned with stressor 17 (note column 9 lines 18-22).



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### ***Conclusion***

**5. THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thomas L. Dickey whose telephone number is 571-272-1913. The examiner can normally be reached on Monday-Thursday 8-6.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan J. Flynn can be reached on 571-272-1915. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information

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for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

**TLD**

**06/05**